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ABSTRACT

An evaluation of a CD-ROM multimedia component of a first grade science curriculum, the IBM/CTW "Through the Woods," is presented. The presentation offers hands-on activities related to forest ecology, such as virtual nature walks. Children participating in the study (n=95) displayed ability to use the technology, a high degree of affect to full-motion video, and mixed reactions to audio. They collaborated well without teacher assistance, but had trouble performing some individual tasks, possibly due to design flaws. Also, the children had a tendency to invent their own "mission," which suggests that there is a need to periodically reinforce the actual mission while they are using it to keep them on task. Changes that might improve the interface are proposed. (BEW)

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Paper (T2-202A)

# Formative Evaluation of a First-grade Multimedia Forest Environment

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## Abstract

An evaluation of a CD-ROM based multimedia component of a first grade science curriculum is presented. Results indicated that children could use the technology, and work together as a group without teacher assistance. However, the children were also unable to execute the specific tasks they were assigned, due to weaknesses in the design of the multimedia content. Changes that should improve this technology are described.

## Introduction

The advent of relatively inexpensive multimedia platforms has produced a conceptual and practical quandary for educators. Multimedia seems to have dramatic educational potential, but how exactly is it to be used? It has become abundantly clear that technology has advanced faster than our understanding of how best to employ it for pedagogical purposes. Given the almost limitless possibilities for the design of such systems, what are the most effective ways to use these technologies to enhance learning in schools? What is the place of such technologies in the classroom's overall organization? The present paper reports the results of an evaluation of one possible model for incorporating multimedia into a new first grade science curriculum.

### Curriculum overview

Before describing the multimedia system and the issues assessed in the study, the curriculum for which it was designed should be briefly reviewed. The IBM/CTW "Through The Woods" science curriculum was developed based on several of the life sciences goals laid out in the California Public Schools Science Framework (1990). It focuses on forest life as representative examples of living things. The material is organized into one-week units, each week having its own theme. Three themes were tested in the present study: (1) Living things are composed of smaller structures or body parts; (2) Living things move in different ways; and (3) all living things need food and shelter to survive and thrive.

The curriculum calls for the classroom to be organized as a set of four stations, each serving a different learning objective: A hands-on station, where children examine live animals and study their behavior; a library station, where children read about animals and record their observations; a courseware station, where children manipulate detailed images of animals and examine animations of their movement and other behavior; and the multimedia station, where children go on a self-guided "nature walk" in a virtual forest and collect observations on actual animals engaged in different behaviors related to the curricular themes.

The multimedia station was designed to serve several purposes. Broadly, the multimedia was meant to provide children with a sense of discovery and exploration, and encourage them to test their ideas of where animals might be found, and to observe what animals do to survive in the forest. More concretely, each week children had a different "mission" to find specific things in the forest related to that week's theme. For example, for the week of the movement theme, children's objective was to explore the forest and find animals moving in different ways.

### Functionality of the multimedia

The multimedia station was a CD-ROM based interactive video system running on an IBM OS/2 platform. The design metaphor for this station was an investigative walk in the forest. There were no menus or other of the standard computer interfaces in the multimedia. Instead, video filmed from the point of view of an individual walking along trails in the Smoky Mountain National Forest served as a three-dimensional "menu," that gave the impression the user was actually walking in the forest itself. Use of the multimedia consisted of children "walking" along the trails, searching for locations where they thought animals might be found. These trails amounted to a total of 12-15 minutes of "walking," if the users did not ever stop along the trail to search for animals.

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Movement on the trail was controlled by a mouse. Icons allowed users to walk forward, stop, back up, or use a map to "jump" directly to one of 12 possible landmarks along the two trails and then walk from there. At any point, users could elect to stop on the trail and point the cursor at places where they thought animals might be found (in trees, under rocks, behind bushes, etc.). In some places along the trail animal sounds played (birds chirping, toads croaking, etc.), as a cue that something could be found nearby.

Highlighting of screen locations when touched by the cursor indicated that a living thing was indeed present. If the location was clicked on, the users were presented with one of three results: (1) A brief, full motion video segment with audio, showing an animal; (2) a high resolution still image of an animal, without audio; (3) a high resolution close-up view of the location clicked on. The close-up view of the selected location contained several videos and stills of animals, and users could find the animals in the still in the same way they found the 'hiding place' on the main trail: Moving the cursor to different places and watching for a highlight.

The videos all showed animals performing specific behaviors, related to the content goals of the curriculum, with ambient audio (birds would chirp, water could be heard if an animal was swimming, etc.). Each video was accompanied by a spoken audio description that included the animal name and information about the animal, tailored to the specific curricular themes. The audio could be heard by clicking on a separate icon accompanying the video.

Every visit to the forest began in a "ranger station" where the children clicked on a mission icon to learn what they were to look for on this particular walk. This was the only statement of their task that they received during the session, unless they replayed the mission statement voluntarily while using the system. The mission icon played a spoken set of instructions without accompanying graphics of any kind (See Table 1 for the text of each week's mission). Children then began their search, finding and recording animals whose behavior or location related to the weekly theme. Children recorded their findings in two ways. First, there was an "online clipboard," which allowed the users to save up to four videos for later examination.

| Week | Mission Statement |
|---|---|
| 1 (Parts) | On this walk, find four animals whose body parts have something interesting or special about them. Put each one on your clipboard so you can compare them when you're done. (You might want to compare their eyes, or months, or legs.) You can circle the pictures on your worksheet to show what body parts you see on the animals you chose. |
| 2 (Movement) | On this walk, find four good examples that show how animals can move. Put each one on your clipboard so you can compare them when you're done. You can circle the pictures on your worksheet to show what ways the animal you chose can move. |
| 3 (Needs) | On this walk, find four animals that are looking for food, water, or a safe place to be. Put each one on your clipboard so you can compare them when you're done. You can circle the pictures on your worksheet to show what the animals you chose are eating or where you found them. |

**Table 1. Mission statements children received in the multimedia.**

In addition to the online clipboard, each child was provided with his or her own real clipboard, and forms containing checklists appropriate to that day's particular mission and the weekly theme. The forms resembled the online clipboard. The child's task was to record each animal's name, and then fill out the checklist of observations about the animal.

### Multimedia usage scenario

The multimedia station was designed to be used by up to four children at a time, for a period of approximately 20 minutes. The children were asked to share the multimedia, and they did this by taking turns "driving" with the mouse. The children were expected to use the multimedia without adult assistance. The rest of the class was engaged with the other three stations while the multimedia was being used.

## Goals of the evaluation

The evaluation of the multimedia station's performance in the context of the Through The Woods (TW) curriculum focused on four areas.

### The interface and design metaphor

The TW interface is based on a point-of-view navigational system, controlled by icons. Can young children use such an interface? Do children understand the metaphor of the nature walk, and what they are to do in their visit to the virtual forest?

### Use of the video and audio information

The content of the multimedia is delivered exclusively through motion video, still images, and spoken audio. The multimedia's stated purpose is to allow children to discover the information it contains as they are walking through the forest. Are young children able to process this information and record it, in keeping with the curricular goals?

### Effectiveness of the usage scenario

The multimedia station is meant to foster independent discovery and exploration by groups of children. Are young children able to work together in small groups, taking turns using the multimedia and recording their discoveries, without adult supervision?

### Mission execution

The content of the multimedia is coordinated with the weekly themes via the specific weekly missions. The missions are delivered to the children by the teachers (announced at the beginning of each class) and by multimedia itself. Are children able to comprehend and execute these missions without the active assistance of a teacher or other adult?

## Method

### Sample and sites

95 children from four classrooms participated in the present study. Two classrooms were in New Jersey; two were located in Florida. Boys and girls were approximately equally represented. Each classroom was provided with all the materials needed for the curriculum.

The children were organized into groups. Each group visited each station once during the week. During the course of the study, each child visited the multimedia station as part of a group once a week for three weeks, for a total of three experiences.

### Procedure

Data was collected from several sources. First, the forms children used during each visit were collected and examined. Second, children were either videotaped or observed with a standardized protocol while using the multimedia. Finally, post-use interviews were conducted with children to ascertain their own notion of what they were doing, and why.

## Results

### Interface and design metaphor

The children demonstrated no problems comprehending the interface. They easily and confidently used the mouse and icons to direct their travel, select animal hiding places, and store video clips in the online clipboard. The children also grasped the metaphor of the nature walk. Their sensations of travel along the forest trails were very vivid: Children were observed ducking to avoid tree branches on the screen, or warning the 'driver' when they thought they might fall into water or otherwise go off the trail. In addition, when wading through water in one segment of the trail that crosses a stream, children often laughed and said "Our feet are wet! Oh, no!" or made other comments suggesting they easily identified themselves with the point of view being displayed during their travel on the trails.

Most striking, the interface and the computer itself appeared to be completely transparent to the children. When describing their use of the multimedia, the children used language related almost exclusively to the content of the activity: "I looked under a rock and I found some ants!", "I heard a bird in the tree and I found it—it was an owl!", etc. Listening to their descriptions, it was impossible to tell that they had not actually gone to a forest and performed the activity they were describing.

### Audio and video content

The children responded to the full-motion video segments with high levels of affect. Images of insects elicited vivid reactions of disgust, for example. Images of baby animals elicited cooing and exclamations of affection. And images of snakes, or large predators (bears) elicited fear reactions (children hiding their eyes, gasping, etc.). Still images, however, were universally derided by the children. Even though the images were quite colorful, the children would ignore them in favor of the motion video segments.

One unexpected finding was that the children showed an aversion to re-examining previously discovered videos of animals. "We found that one already!" was a common comment by the children when the an animal discovered on an earlier

visit was discovered again. Even when the rediscovered video or audio content was directly related to that week's mission, children would not record it. They showed a persistent preference for finding new animals (see mission performance results, below).

The audio produced mixed results. The animal sounds heard along the trails, or as part of the videos, were especially compelling to the children. They would imitate sounds, and in the case of hidden animals they would guess what produced it, and always searched diligently to locate the animal. The spoken information accompanying each animal, however, was often ignored. Children would talk over it, not play it at all, or simply exit the video while the audio was still playing.

### Usage scenario

The children's performance as a group was remarkably free of rancor or competition. Whatever method of sharing mouse control was used, the group worked together searching for animals quite well. Children who were not 'driving' constantly made suggestions about where to search for animals, and the 'drivers' heeded these suggestions in a majority of cases. In addition, the print forms provided for each child to record the animals found by that group functioned very well as an activity for the nondrivers. When animals were found, the nondrivers would confer with one another about what to record, or how to spell animal names, as they filled in the forms.

### Mission performance

While the interface, group dynamics, etc. worked well, the children were unable to execute the specific missions assigned each week. They tended to listen to the mission statement, but uncomprehendingly. Instead of examining the images of animals in relation to the mission criteria, children simply created their own "mission," which was always the same: To search for as many different animals as possible.

In a similar vein, children's recording of their "findings" was deficient. The use of the online clipboard was spontaneous and idiosyncratic, rather than task-related. Children saved images in the clipboard because they "liked" them, or because the image was unusual. They used their real clipboards in a similar manner. Examining their written work later, it was difficult to tell which animals the group had seen because they failed to record this information accurately or consistently.

## Conclusions

The multimedia station clearly succeeded in its broad goals of fostering independent discovery, and of stimulating children to explore the forest and test their ideas about where animals might be found. Children found the "nature walk" metaphor highly engaging, and the interface design was so natural as to be transparent to the children in their experience of the system. The use of motion video and audio in the form of animal sounds likewise was very effective in conveying a vivid sense of actually exploring a forest environment. The usage scenario also appears to be viable for children at this age. The children in the study took turns using the mouse in an orderly fashion, without adult supervision. Children controlling the technology also listened and responded to the suggestions of their fellow students when searching for animals, fostering a sense of collective effort.

The weaknesses of the multimedia's design were in the way it used spoken audio, both to present information and to support mission execution. Both the spoken audio information accompanying the videos and the content of the mission were apparently too long, and contained vocabulary too abstract, for children to process and understand. The mission statements did not explain to children what they were to do in a sufficiently specific, concrete way. This finding reflects the results of previous work on preschoolers and spoken audio (Strommen, 1991), and suggests that the same standards for audio appropriate for that age (brevity, concreteness, directed action, etc.) are appropriate for first grade children as well.

Even if the missions were more clearly stated, the children's strong tendency to invent their own "mission" suggests that there is a need to periodically reinforce the actual mission while children use the multimedia, so they can stay on task. There were no audio or other cues built into the system to remind children of the goal of the mission they were to be executing; once they had listened to the mission statement at the beginning of their session with the multimedia, they were never prompted about what they were doing or why. Adding prompts at key interactions during use could be very effective. The prompts could be designed to play when children select animals ("What body parts does this animal have?"), or when they are saving animals to their online clipboard ("Does that animal show a special body part??"). Including such "reminders" may be critical if there is to be no adult supervision to assist children in staying on task.

In closing, the present results indicate that multimedia technology can be a viable component of the particular classroom and curricular context tested in the present study. Groups of children can use the technology independent of adult guidance, and they can execute the general task (searching for animals in a simulated nature walk) that it was designed to support. However, the technology's open-ended quality also turned out to be something of a weakness. The specific content of each nature walk, which relates to the content goals of the curriculum itself, was apparently not effectively delivered to the children. Changes in the design of the multimedia to enhance on-task performance are necessary. Such changes should



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improve children's use of the multimedia, and improve its pedagogical impact as part of the science curriculum for which it was designed.

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